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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant:	Tomohisa ARAI et al.
Title:	CUTTER COMPOSED OF NI-CR ALLOY
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Examiner:	Tima Michele McGuthry Banks
Art Unit:	1793
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DECLARATION UNDER 37 C.F.R. § 1.132

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

I, Takashi Rokutanda, declare as follows:

1. I am one of the inventors of the application identified above. I have reviewed the Office Action dated April 23, 2009.

2. I graduated from the Graduate School of Engineering of Osaka University in March 1989 with a Master of Engineering degree from the Department of Metallurgical Engineering.

3. My experience includes employment with Kabushiki Kaisha Toshiba since April 1989. I have worked in various technical fields, including sealing materials, parts for electronic devices, and special metals and alloys, such as heat resistant alloys and corrosion

resistant alloys. After 1999, I have been involved with the research and development of a Cr-Al-Ni alloy for a cutter. I have filed numerous domestic and foreign patent applications relating especially to the metallic materials for a cutter.

4. The following experiments were carried out under my supervision and control to explain the advantages of including various elements in the alloy for this application.

5. Various powder material compositions were prepared as samples 1-16, as listed in Table 1. Sample 1 was prepared as a "standard" sample based on Sample No. 36 disclosed in the application, as indicated in Table 3 on page 30 of the application. Sample 2 was prepared based on Example 1 of the application, as disclosed on page 19, line 25, to page 22, line 11, of the specification. Samples 3-8 were prepared on the basis of the Cr, Al, and Mg compositions disclosed by the application. Samples 9-14 were prepared as samples in which the amounts of Mg, Ca, B, RE (rare earth element), P, O, S, Mn, Cu, and Si were set as relatively larger values. Samples 15 and 16 were prepared based on examples 2 and 7 in Table I of U.S. Patent No. 3,015,558 to Grant *et al.* (hereafter "Grant").

6. Samples 1-14 were processed similarly to Example 1 in the application, as discussed on page 19, line 25, to page 22, line 11, of the specification. More specifically, each material powder composition of the samples was melted and cast by a vacuum melting process. The resultant casting was forged and rolled to prepared a blank plate, as shown in Figure 1 of the application. The blank plate had dimensions of: 300 mm in width, 2000 mm in length, and 4.4 mm in thickness. The blank plate was subsequently solution heat treated at 1200°C in a vacuum heat treatment furnace with the use of an argon atmosphere and then quenched by submersion in oil. The surface of each blank plate for samples 1-14 was ground by 0.2 mm to remove a surface layer altered by quenching.

7. Samples 15 and 16, the samples corresponding to examples 2 and 7 in Table I of Grant, were prepared in substantially the same way as samples 1-14 except that samples 15 and 16 were melted under a sub-atmospheric pressure of 300 mm of Hg of argon, as discussed in col. 3, lines 44-54, of Grant.

8. The blank plates for samples 1-16 (now 300 mm in width, 2000 mm in length, and 4 mm in thickness) were cut with a laser cutter to prepare a formed body having a knife shape. For the formed bodies, the dimensions of the blade part were 160 mm x 40 mm and the dimensions of the grip part were 80 mm x 20 mm. A drilling machine was used to form grip-fixing holes in the grip part of the formed bodies. In addition, a belt grinder was used to grind the blade part form a wedge-shaped cross-section to prepare a cutter blank. The cutter blanks had a leading edge with a thickness of 0.5 mm. The surface of the cutter blanks were polished with the belt grinder and a polisher to form a mirror finished surface. Subsequently, the cutter blanks were charged into a vacuum furnace and the pressure within the vacuum furnace was reduced. The cutter blanks were subjected to an aging heat treatment of 700°C for two hours in an argon atmosphere, cooled to about 150°C for one hour in the argon atmosphere, and then removed from the furnace. The surfaces of the cutter blanks were tarnished to some degree by the aging heat treatment and a final polishing step was performed on the cutter blanks to provide a mirror finish with a high aesthetic quality. A grip was subsequently attached to the grip portion to provide a blade part, which was then sharpened at an angle of 15 degrees with an oil stone to prepare samples 1-16 as knives, as shown in Figure 2(B) of the application. The hardness of a flat area of each knife was measured with a Rockwell hardness tester.

9. Samples 1-16 were tested in accordance with those used for Example 1, as discussed on page 19, line 25, to page 22, line 11, of the specification. More specifically, the composition of samples 1-16, including impurities, was determined by X-ray analysis in an electron probe microanalyzer (EPMA).

10. The durability of each blade for samples 1-16 was determined with a rope cut tester, as shown in Figure 2(A) and 2(B) of the application. The linear blade part of each knife was pressed onto a hemp rope having a diameter of 10 mm, which is object 14 cut in Figures 2(A) and 2(B) of the application. To fix the rope, a part of the hemp rope to be cut, with a width of 4.1 mm, was fixed to a fixing jig 13. A knife sample 7 was then inserted into the fixing jig 13 to perform the cut test. During cutting, as indicated in Figure 2(B) of the application, the knife was reciprocated in a horizontal direction while a load of 2 kg was applied to the knife. A horizontal moving distance of the knife L required to completely cut

the hemp rope was repeatedly measured. The included Table 1 shows the results measured for the cut test for each sample.

11. Vickers hardness and hot workability of the samples were measured in accordance with the method used for Example 7 of the application, as discussed on page 27, line 2, to page 28, line 6, of the specification. More specifically, the Vickers hardness (Hv 0.5 with a test load of 4.903 N) was measured after solution heat treatment and the surface hardness (on the Rockwell C scale) was measured after the aging heat treatment. Hot workability was evaluated for each sample on the basis of a production yield calculated by subtracting defective material that caused cracking and fracture during working from the amount of input material. Production yields of the sample were represented by a weight percentage of the produced blank to the amount of input material. An evaluation symbol + represents that the production yield was 70% or more, an evaluation symbol O represents that the yield was from 50% to 69%, an evaluation symbol Δ represents that the yield was from 40% to 49%, and an evaluation symbol X represents that the yield was 39% or less. Because the measured values of the moving distance L required by the knife to cut the rope fluctuated considerably, depending on the cut operation (number of cuts), the average horizontal moving distance is provided in the enclosed table for each knife.

12. As shown in the enclosed table, samples 1-8, which had compositions corresponding to claim 6, mostly exhibited good to excellent hot workability. In contrast, samples 9-16 exhibited poor to fair hot workability. In addition, samples 1-8 exhibited a significant improvement in cutting performance over samples 9-16, as demonstrated by the reduced values of average horizontal moving distance for samples 1-8. In particular, samples 1-8, whicb correspond to claim 6, show a significantly improved cutting performance in comparison to samples 15 and 16, which correspond to Examples 2 and 7 of Grant. Furthermore, samples 15 and 16 exhibited poor hot workability. Thus, samples 1-8 exhibited a combination of superior cutting performance and hot workability not exhibited by samples 9-16.

13. Samples 9-14, which were provided to demonstrate the effect of excessive amounts of additive elements, demonstrated lower quality workability and a reduced cutting

performance in comparison to samples 1-8. Such additive elements can provide non-trivial effects for this alloy, as demonstrated by the results in the enclosed table.

14. I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements are made with knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title XVIII of the United States Code and that willful false statements may jeopardize the validity of this Application for Patent or any patent issuing thereon.

Executed on: Oct. 22, 2009 Takashi Rokutanda

Date Takashi Rokutanda

Table 1

Sample	Range in Application (mass%)	Cr 32 - 44	Al 2.3 - 6	Mg 0.005 - 0.025	Ca 0.005 - 0.02	B 0.005 - 0.03	RE 0.005 - 0.02	Mg+Ca+B 0.015 - 0.03	P	O	S	P+O+S ≤0.003	Mn	Cu	Si	Mn+Cu+Si ≤0.03	Ni Bal.
1	"Standard" (No. 36 of App.)	39	3.78	0.023	0.002	0.003	0	0.028	0.0003	0.0005	0.0005	0.0013	0.003	0.001	0.004	0.008	Bal.
2	Example 1 of App.	38.1	3.81	0.013	0.005					0.002			0.01		0.01		Bal.
3	Low Amount of Cr	32	3.8	0.01	0.005	0.005	0.005	0.02	0.0003	0.0005	0.0005	0.0013	0.003	0.001	0.004	0.008	Bal.
4	Large Amount of Cr	44	3.8	0.01	0.005	0.005	0.005	0.02	0.0003	0.0005	0.0005	0.0013	0.003	0.001	0.004	0.008	Bal.
5	Low Amount of Al	38	2.3	0.01	0.005	0.005	0.005	0.02	0.0003	0.0005	0.0005	0.0013	0.003	0.001	0.004	0.008	Bal.
6	Large Amount of Al	38	6	0.01	0.005	0.005	0.005	0.02	0.0003	0.0005	0.0005	0.0013	0.003	0.001	0.004	0.008	Bal.
7	Low Amount of Mg	38	3.8	0.005	0.005	0.005	0.005	0.015	0.0003	0.0005	0.0005	0.0013	0.003	0.001	0.004	0.008	Bal.
8	Large Amount of Mg	38	3.8	0.015	0.005	0.005	0.005	0.025	0.0003	0.0005	0.0005	0.0013	0.003	0.001	0.004	0.008	Bal.
9	Excessively Large Amount of Mg	38	3.8	0.028	0.005	0.005	0.005	0.038	0.0003	0.0005	0.0005	0.0013	0.003	0.001	0.004	0.008	Bal.
10	Excessively Large Amount of Ca	38	3.8	0.01	0.03	0.005	0.005	0.045	0.0003	0.0005	0.0005	0.0013	0.003	0.001	0.004	0.008	Bal.
11	Excessively Large Amount of B	38	3.8	0.01	0.005	0.04	0.005	0.055	0.0003	0.0005	0.0005	0.0013	0.003	0.001	0.004	0.008	Bal.
12	Excessively Large Amount of RE	38	3.8	0.01	0.005	0.005	0.03	0.02	0.0003	0.0005	0.0005	0.0013	0.003	0.001	0.004	0.008	Bal.
13	Excessively Large Amount of P+O+S	38	3.8	0.01	0.005	0.005	0.005	0.02				0.0035	0.003	0.001	0.004	0.008	Bal.
14	Excessively Large Amount of Mn+Cu+Si	38	3.8	0.01	0.005	0.005	0.005	0.02	0.0003	0.0005	0.0005	0.0013				0.035	Bal.
15	Example 2 of Grant	40	4	None													56
16	Example 7 of Grant	38	6	None													56

Sample	Range in Application (mass%)	Hardness Hv 0.5 (after sol. treat.)	Hot Workability	Hardness HRC after Aging 52 or more	Avg. Grain Size 1 mm or less	Avg. Horiz. Moving Distance at the Thousandth Cut (mm)
1	"Standard" (No. 36 of App.)	165	+	60	0.94	26
2	Example 1 of App.	163	O	59	0.98	28
3	Low Amount of Cr	161	O	58	0.90	31
4	Large Amount of Cr	167	O	60	0.90	34
5	Low Amount of Al	161	O	59	0.95	30
6	Large Amount of Al	170	O	61	0.88	33
7	Low Amount of Mg	160	Δ	59	0.95	35
8	Large Amount of Mg	168	+	60	0.95	26
9	Excessively Large Amount of Mg	170	Δ	61	0.75	44
10	Excessively Large Amount of Ca	171	X	62	0.79	64
11	Excessively Large Amount of B	167	Δ	64	0.75	58
12	Excessively Large Amount of RE	168	X	63	0.80	61
13	Excessively Large Amount of P+O+S	175	X	64	0.79	59
14	Excessively Large Amount of Mn+Cu+Si	174	X	64	0.87	58
15	Example 2 of Grant	160	X	59	0.94	49
16	Example 7 of Grant	162	X	60	0.92	52